The Quantity of Solar Nutation as affecting the North Polar Distances of the fixed Stars deduced from Observation, and the Application of this Determination to confirm the Conclusions relative to the Parallaxes of certain fixed Stars. *By the Rev.*

John Brinkley, *D. D. F. R. S. President of the R. I. A. and Andrews' Professor of Astronomy in the University of Dublin.*

Read April 1, 1822.

IN the Twelfth Volume of the Transactions of the Royal Irish Academy, an account was given of observations made at the Observatory of the College, by which the annual parallaxes of certain fixed stars appeared to be determined.

Mr. Pond immediately referred to the observations made at the Royal Observatory, Greenwich, with the new mural circle; and, although some small changes of place appeared to have been exhibited by the observations made with that instrument, he was of opinion, that those changes did not arise from parallax.

To ascertain this point with greater certainty, he procured fixed telescopes of considerable length to be erected at Greenwich, and furnished with micrometers; by which stars nearly opposite in right ascension, and having nearly the same zenith distance, could be examined.

The result of his observations appeared entirely adverse to my conclusions. His objections were stated in several papers in the Transactions of the Royal Society.

There were some circumstances, that made me feel considerable

confidence in my results; but, in a matter so difficult, and in which the quantities in dispute were so small, I was unwilling to do more than repeat an account of my observations, and give my reasons for calling in question Mr. Pond's conclusions. This was done in a paper published also in the Phil. Trans. for 1818.

I then determined to institute a very extensive series of observations for examining this question in various ways.

The results of a great number of observations made with our eight feet astronomical circle, during upwards of three years, were given in the Phil. Trans. for 1821. These, when duly considered, must be allowed to have added great weight to my former conclusions; but there still appeared to be wanting those convincing arguments, that were to be desired in a matter of such importance, and which had so long baffled the exertions of astronomers. Besides, results were obtained with respect to several stars, that appeared to involve the enquiry in new difficulties.

The observations have been continued, and it has recently occurred to me, that, from the great number of observations, which have been made of certain stars, I could apply them to finding the *solar nutation*, as well as the *parallax* and *aberration*.

The solar nutation deduced from theory has long been used by astronomers in the correction of the observations in north polar distance. No doubt remains of its actual quantity within narrow limits. Its maximum is very nearly half a second in north polar distance for all stars. This quantity, less than what I had found for the parallax of certain stars, would, I considered, if ascertained by my observations, shew the exactness of them, and the capability of the instrument to point out such small quantities.

The solar nutation goes through all its states twice in the course of a year; therefore it appears impossible to suppose, that, if any

cause should occasion the instrument to shew deviations explained by parallax which did not actually exist, it should not derange the solar nutation, and cause the result of an investigation of its quantity to turn out quite erroneous.

This method of investigation, which I have applied to several stars, has produced most satisfactory results.

There will not, I conceive, remain the smallest doubt with any one, who examines the processes which have been used, that the observations have ascertained the quantities of parallax, with considerable exactness, of the stars α *Lyræ*, α *Cygni*, and *Arcturus*, and that the parallaxes of γ *Draconis* and η *Ursæ Majoris* are extremely small. That γ *Draconis* is at least seven or eight times more distant than α *Lyræ*.

The application of the same method to α *Aquilæ* and α *Ophiuchi* has shewn, that the conclusions formerly deduced from the observations of these stars cannot be depended on. There appear reasons for supposing, that the parallax of these stars may be considerable; but, for the present, I am willing to leave the matter entirely in doubt. The great zenith distances of these stars appear to have been attended with an irregularity of refraction, which has mixed itself with the other changes of place; as will be more particularly considered, when the computations as to α *Aquilæ* are stated.

The results of this enquiry are connected with several important points in practical astronomy. It has not before been attempted, as far as I know, to ascertain by actual observation the quantity of solar nutation. The precision with which this equation, mixed up with the other various complicated apparent motions, has been ascertained, shews an advanced state of instruments that formerly would scarcely have been hoped for.—Newton, who pointed out from theory the existence of the solar nutation, (the lunar so much

larger escaped his notice,) speaks of it as "vix aut ne vix quidem sensibilis."

The existence of a visible parallax in N. P. D. in certain stars, in one at least greater than the solar nutation, that has so long been adopted by astronomers, will be considered to add to the troublesome corrections already used in finding the mean place of a star. It is true, that, with respect to polar distances, it is probable this correction may be sensible only in a few stars; but it may be quite otherwise as to the right ascensions of stars near the ecliptic. Then, unless it be attended to in deducing the catalogue of right ascensions, considerable inaccuracy will take place. May not this have been the source whence the differences have arisen in the recent determinations of right ascension, deduced from observations made with the best instruments?

Should it be necessary to consider the constant of aberration as unknown, there will be required, for settling the relative places in right ascension of two stars only, six unknown quantities (e, x, p, for each star). Therefore it would require labour almost interminable to deduce an *exact* catalogue in right ascension of the 36 stars.

It may be said, that this exactness would be useless. If so, it must be admitted, that the right ascensions will be less exact than the polar distances.

The inconveniences that belong to the use of the transit instrument will also belong to the mural circle, unless means be used for referring the observations to the zenith point. This would probably deprive the results of several advantages intended by the adoption of mural circles. Hence a question of much importance arises, Will not the continuation of the construction of mural circles tend to impede the progress of our enquiries relative to the fixed stars?

Doubtless weighty arguments may be adduced for the constant

of aberration being the same in all stars, whether we have a reference to the undulatory or corpuscular theory of light. But neither one or other of these is necessarily true. If the corpuscular theory be adopted, some unknown properties of matter are required to explain the phenomena.—Indeed so many difficulties occur in all our reasonings relative to light, that it is desirable to avail ourselves of actual observation wherever it can be done.

The resulting constants for γ Draconis and η Ursæ Majoris appear to point out a difference, that, considering the small errors of the quantity of solar nutation deduced from each of these stars, must be thought deserving of great attention with a view to further enquiry.

To these remarks it may be added, that the results of these observations afford the indulgence of a laudable curiosity, instructing us as to the actual distance of some of the fixed stars. It is shewn that the vast abyss of space, through which the fixed stars are placed, is not, in all its parts, more remote than our means of measurement can reach.

I now proceed to state, 1. The quantity of solar nutation as deduced from theory. 2. The results of the observations of certain stars as to this quantity, parallax, and aberration.

Solar Nutation by Theory.

By a reference to the Mecanique Celest. p. 348, 349 and 350, Tom. 2. it will easily appear that the solar nutation in N. P. D.

$$= \frac{l \tan \text{ob. ecl.}}{2m(1+\lambda)} (\cos \text{ob. ecl.} \sin 2\odot \cos AR - \cos 2\odot \sin AR)$$

where $\frac{l}{m} = \frac{155{,}2}{3999930}$ and $\lambda = \frac{\text{disturb. force of the moon on the earth.}}{\text{disturb. force of the sun.}}$

If we use the lunar nutation for finding the value of λ, and suppose

the max. of nutation of the obliquity of the ecliptic $=9'',50+y$, the same work, p. 348, gives for this

maximum $\frac{l\lambda c'}{(1+\lambda)f \sin 1''}$ when $\frac{l}{f}=\frac{155.2}{215063}$ and $c'=\tan 5°.8'.48''$

Hence $\frac{1}{1+\lambda} = \frac{3,907-y}{13,407}$

Therefore $\frac{l \tan \text{ob. ecl.}}{2m(1+\lambda)} = 0'',5062-,1296y$

Let $z = 0'', 5062-,1296y$

Then the solar nutation in N. P. D $=$ (cos. ob. ecl. sin $2\odot$ cos A.R. —cos $2\odot$ sin A. R)z.

The smallest value that has been assigned for the max. of lunar nutation of ob. ecl. is $8'',97$, which has been deduced by Lindenau.

This gives $y=-0'',52$, and therefore $z=0'',57$.

The greatest value for this max. is that which is deduced by supposing $\lambda=3$ as determined at first by M. Laplace, by the tides at Brest. This value of λ gives $9,50+y=10'',055$ and the value of $z=0'',43$. But the illustrious author himself has shewn, that this value of λ is too great. (Mec. Cel. Tom. 3. p. 159.)

There cannot be a doubt that the value of z is between $0'',43$ and $0'',58$. According to a high degree of probability $0'',51$ is a very near value.

Taking the value of the lunar nutation deduced by my observations, as given in the Phil. Trans. 1821, the value of $z=0'',537$.

Let us now investigate the value of z from actual observation.

Observations of α Lyræ.

The observations of the zenith distances of this star are given at length, in order that the whole process, by which the results are

obtained may be examined. For the other stars, the principal results are only given.

The observed zenith distances are reduced to the mean zenith distance, Jan. 1, 1819, by applying the usual equations with the contrary sign.

1. The precession in N. P. D. the annual value of which is—$3'',00$

2. The aberration, the constant of which is $20'',25$

3. The solar nutation $= 0'',48 \sin(2 \odot \text{Long.} - \text{A.R})$

4. The lunar nutation $= 8'',28 \sin(\text{A.R} - \Omega) - 1'',22 \sin(\text{AR} + \Omega)$

5. The refraction has been computed by my Table given in vol. 12.

The sum of these five equations, according to their signs, is called the sum of the equations.

A mean of a considerable number of observations, made throughout the year, and reduced to January 1, 1819, gives the zenith distance $= 14^\circ. 41'. 56'', 41$. This must be nearly equal to the mean zenith distance.

Let the correct mean zenith distance $= 14^\circ. 45'. 56'',41 - e$

$p =$ semi-parallax

$20'',25 + x =$ constant of aberration

$z =$ the constant of solar nutation, the coefficient of which is above given.

Hence, if m be the mean zenith distance determined by the observation of any one day, reduced by the sum of four equations, *omitting* the solar nutation, and supposing its quantity unknown, we obtain an equation of the form

$$m + fx + gp + hz = 14^\circ. 45'. 56'',41 - e$$

or, making $m - 14^\circ. 45' 56'',41 = k$

$$e + fx + gp + hz + k = 0$$

We thus obtain *an equation of condition* for each day.

On those days, in which two observations were made, one with the face of the circle East and one with the face West, one equation is considered equivalent to two deduced from observations made on different days. Indeed, since the method of observing off the meridian has been generally adopted here, the result of two observations of one day appears, as might be expected, more exact than the mean of two observations on different days.

The equations of condition, in number 208, thus obtained, are given at the end of this paper; and, doubling those when the circle was reversed, the number amounts to 333.

These have been reduced to four equations, by the method of making the sum of the squares of the errors a *minimum*, viz. making

$$(e+fx+gp+hz+k)^2+(e+f'x+g'p+h'z+k')^2+\text{ \&c. a min.}$$

Taking the fluxions of these quantities, making e, x, p, and z vary separately, we obtain four equations.

$$1.\quad \left.\begin{matrix}1\\1\\\text{\&c}\end{matrix}\right\} e+\left.\begin{matrix}f\\f'\\\text{\&c}\end{matrix}\right\} x+\left.\begin{matrix}g\\g'\\\text{\&c}\end{matrix}\right\} p+\left.\begin{matrix}h\\h'\\\text{\&c}\end{matrix}\right\} z+\left.\begin{matrix}k\\k'\\\text{\&c}\end{matrix}\right\} =0$$

$$2.\quad \left.\begin{matrix}f\\f'\\\text{\&c}\end{matrix}\right\} e+\left.\begin{matrix}f^2\\f'^2\\\text{\&c}\end{matrix}\right\} x+\left.\begin{matrix}fg\\fg'\\\text{\&c}\end{matrix}\right\} p+\left.\begin{matrix}fh\\f'h'\\\text{\&c}\end{matrix}\right\} z+\left.\begin{matrix}fk\\f'k'\\\text{\&c}\end{matrix}\right\} =0$$

$$3.\quad \left.\begin{matrix}g\\g'\\\text{\&c}\end{matrix}\right\} e+\left.\begin{matrix}fg\\fg'\\\text{\&c}\end{matrix}\right\} x+\left.\begin{matrix}g^2\\g'^2\\\text{\&c}\end{matrix}\right\} p+\left.\begin{matrix}gh\\g'h'\\\text{\&c}\end{matrix}\right\} z+\left.\begin{matrix}gk\\g'k'\\\text{\&c}\end{matrix}\right\} =0$$

$$4.\quad \left.\begin{matrix}h\\h'\\\text{\&c}\end{matrix}\right\} e+\left.\begin{matrix}fh\\f'h'\\\text{\&c}\end{matrix}\right\} x+\left.\begin{matrix}gh\\g'h'\\\text{\&c}\end{matrix}\right\} p+\left.\begin{matrix}h^2\\h'^2\\\text{\&c}\end{matrix}\right\} z+\left.\begin{matrix}hk\\h'k'\\\text{\&c}\end{matrix}\right\} =0$$

The coefficients appertaining to e, x, &c. in each equation being added together, we have

1. $333e+49{,}04\,x-43{,}96\,p+24{,}52\,z+36{,}33=0$
2. $49{,}04e+117{,}4032\,x+36{,}4579\,p-9{,}0401\,z-48{,}2507=0$
3. $-43{,}96e+36{,}4579\,x+140{,}2564p-25{,}7204z-150{,}7903=0$
4. $24{,}52e-9{,}0401x-25{,}7204\,p+180{,}7742z-60{,}9190=0$

The solution of these equations give

$$z=+\,0'',5055\ *$$
$$p=+\,1{,}1380$$
$$x=+\,0{,}1011$$
$$e=-\,0{,}0110$$

The exactness of this value of z affords exceeding strong presumption, that the values of e, x and p, are also very exact.

But the supposition of z being unknown has the effect of rendering the number of observations used only equivalent to a smaller number when z is considered as known. It is evident the greater the number of quantities that are to be determined from a series of observations, the greater is the number of observations that will be required to give equal exactness. Thus, if e and p only are to be found, a smaller number of observations will give e and p exact: that is, the errors of observation will have less effect than if e, p and x are considered unknown; and if e, p and x only are to be found, the results are likely to be more exact from the same observations than if e, p, x, and z are to be found.

Therefore, although four quantities have been investigated from the above 333 observations, yet as one of them, z, was before known, it is likely the result will be more exact taking this

* Four places of decimals have been retained in the multiplication of the coefficients, that, as far as computation is concerned, the values of e, x, p, and z, may be exact to the second decimal place.

as known. Then the *three* final equations, obtained by the above method, will be

1. $333e+49,04\,x-43,96p+48,51=0$
2. $49,04e+117,4032\,x+36,4577p-52,3657=0$
3. $-43,96e+36,4579\,x+140,2564p-162,3572=0$

These equations give

$p=+1'',1277$ or $2p=2'',25$

$x=+0,\ 1007$ or constant of aberration $=20'',35$

$e=-0,0116$ or mean N. P. D. Jan. 1, $1819=51°.\ 22'\ 42'',92$

Here the differences resulting from supposing z known and unknown are not worth notice.

Observations of γ Draconis.

For this star the mean zenith distance Jan. 1, 1819, has been supposed $=1°.\ 52'\ 21'',13-e$.

p, x, and z represent as before. The number of observations are 199.

The four resulting equations, deduced in the manner that has been explained at considerable length, and by a reference to the observations for α Lyræ, are

1. $199e+48,76x-28,90p+22,44z-16,27=0$
2. $48,76e+82,5802x+35,8977p-20,9436z+39,9305=0$
3. $-28,90e+35,8977x+101,6398p-24,9353z+26,4376=0$
4. $22,44e-20,9436x-24,9353p+92,5526z-51,8999=0$

These equations give

$$z=+0'',4246$$
$$p=+0,0704$$
$$x=-0,5056$$
$$e=+0,1681$$

This value of z may be considered as not differing more than $\frac{1}{10}$ of

a second from the truth; and therefore it may fairly be concluded, that the errors of p and x are not much greater.

The values obtained from the *three* equations deduced by supposing the solar nutation known are probably more exact. These equations are

1. $199e+48,76x-28,90p-5,77=0$
2. $48,76e+82,5802x+35,8977p+23,9894=0$
3. $-28,90e+35,8977x+101,6388p+18,6693=0$

The solution gives

$p=-0'',0332$

$x=-0,3395$ or const. of aberration $=19'',91$

$e=+0,1074$ or mean N. P. D. Jan. 1, 1819 $=38^\circ\ 29'\ 7'',52$.

The small negative value of p, arising from the unavoidable effect of the errors of observation, seems to shew, that the value of p does not amount to $\frac{1}{10}$ of a second; and therefore, that this star is ten times more remote than α Lyræ.

I am aware, that to many it will appear almost absurd to rely on these small fractions of a second—I hope they will not adhere to this opinion without carefully examining the steps, by which these conclusions have been obtained.

Observations of η Ursæ Majoris.

For this star the mean zenith distance Jan. 1, 1819, has been supposed $=3^\circ.\ 10'.\ 0'',60-e$

The four resulting equations that have been deduced as before, from 144 observations, are

1. $144e+15,63x-6,99p+64,56z-19,07=0$
2. $15,63e+42,2115x+25,5393p-8,2082z-13,1740=0$
3. $-6,99e+25,5393x+71,0775p-9,4177z-13,4576=0$
4. $64,56e-8,2082x-9,4177p+60,8238z-19,8381=0$

$$z = +0'',5782$$
$$p = +0,0950$$
$$x = +0,4295$$
$$e = -0,1688$$

This value of z also may be considered as not differing $\frac{1}{10}$ of a second from the truth. *

Taking the solar nutation $=$, 48 sin (2☉—A.R.) as known, the *three* equations are

(1) $144e + 15,63x - 6,99p + 13,76 = 0$

(2) $15,63e + 42,2115x + 25,5393p - 17,6855 = 0$

(3) $-6,99e + 25,5393x + 71,0775p - 18,5022 = 0$

Then

$$p = +,1003 \text{ or } 2p = 0'',20$$
$$x = +,4083 \text{ or const. aberr.} = 20'',66$$
$$e = -1350 \text{ or mean N. P. D. Jan. 1, 1819} = 39^\circ\, 46'\, 47'',23.$$

It appears difficult to imagine, that the results relative to the constants of aberration for this star and γ Draconis, considering the exactness of the values of z, should be so inexact as to differ by $\frac{3}{4}$ of a second, if they were really the same. The different values of the constant of aberration for these two stars appear to shew an actual difference in the velocities of the light of the two stars.

* The observations of this star were not made at the times best adapted for giving the value of z. The original intention being only to ascertain x and p, the observations were made as far as could be done when the coefficients of x and p were considerable as to both positive and negative values. In consequence of this, it has happened, that, for several high stars, the observations that have been made cannot be applied to find z. In this star, η Ursæ Majoris, the coefficient of z in the first equation being so great as $+$ 64, 56 in only 144 observations shews that they have been principally made when the coefficients of z were positive. The consequence is, that z has a tendency to confound itself with e. However, in this instance, this inconvenience has not arisen. For α Lyræ, γ Draconis, α Cygni, and α Aquilæ, the observations are as well adapted for finding z as for finding x or p.

Observations of α Cygni.

For this star the mean zenith distance Jan. 1, 1819, has been supposed = $8^\circ.44'\,55'',60-e$.

The four resulting equations that have been deduced from 228 observations are

1. $228e+54,80x-34,64p-22,22z+83,00=0$
2. $54,80e+91,4964x+26,9658p-15,4834z+3,0558=0$
3. $-34,64e+26,9658x+92,0096p-34,2084z-37,2714=0$
4. $-22,22e-15,4834x-34,2084p+98,1338z-42,1174=0$

Whence

$$z=+0'',5572$$
$$p=+0,5003$$
$$x=+0,0624$$
$$e=-0,2487$$

Here also the value of z comes out considerably exact.

The *three* equations for obtaining probably more exact values of p, x and e, are

1. $228e+54,80x-34,64p+72,94=0$
2. $54,80e+91,4964x+26,9658p-4,9208=0$
3. $-34,64e+26,9658x+92,0096p-53,6798=0$

Therefore

$x=+0'',0802$ or const. aberr. $20'',33$

$p=+0,4584$ or $2p=0'',92$

$e=-0,2696$ or mean N. P. D. Jan. 1, 1819 $=45^\circ\,21'\,42'',37$

The value of the semi-parallax is probably exact to $\frac{1}{10}$ of a second.

Observations of Arcturus.

The mean zenith distance of this star Jan. 1, 1819, has been supposed$=33^\circ\ 15'\ 27'',20-e$.

The four equations resulting from 348 observations made on 115 days, are

1. $348e+33,64x-16,36p+126,28z-76,96=0$
2. $33,64e+39,9964x+11,3856p-47,7996z+25,8384=0$
3. $-16,36e+11,3856x+90,0412p-10,8096z-47,1152=0$
4. $126,28e-47,7996x-10,8096p+238,8556z-134,9456=0$

Hence

$$z=+0,4430$$
$$p=+0,6524$$
$$x=-0,4123$$
$$e=+0,1309$$

The value of z is exact to less than $\frac{1}{10}$ of a second, notwithstanding the observations were not made at the times most favourable for finding the value of z. This will appear from a comparison of the coefficients of z in equation 1 and equation 4. The coefficients of x in equation 1 and equation 2 also shew, that these observations are still more unfavourable for finding the exact value of x. The coefficients of p in equation 1 and equation 3 shew, on the contrary, the equations are well adapted for finding the value of p.

The *three* equations giving probably more exact values are

1. $348e+33,64x-16,36p-13,96=0$
2. $33,64e+39,9964x+11,3856p+1,6388=0$
3. $-16,36e+11,3856x+90,0412p-52,4356=0$

These give

$p=+0'',6393$ or $2p=1'',28$

$x=-0'',3069$ or const. aberr. $19'',94$

$e=+,0999$ or mean N. P. D. Jan. 1, 1819$=69^\circ\ 52'\ 13'',60$

Observations of α Aquilæ.

The equations resulting from the observations of this star do not give the value of z nearly exact. The equations resulting from 395 observations made in 154 days, are

1. $395e+58{,}43x-7{,}77p-63{,}21z-21{,}28=0$
2. $58{,}43e+64{,}9925x+18{,}9386p-15{,}1838z-85{,}4772=0$
3. $-7{,}77e+18{,}9386x+40{,}9277p-14{,}3921z-74{,}0507=0$
4. $-63{,}21e-15{,}1838x-14{,}3921p+184{,}8813z-132{,}5715=0$

These give

$$z=+0'',9643$$
$$p=+1{,}7311$$
$$x=+0{,}9438$$
$$e=+0{,}1027$$

It is evident, from this value of z, that some irregularity from an unknown source has taken place.

The five stars, that have been before examined, are all, with the exception of Arcturus, within a few degrees of the zenith; and any irregularity of refraction, that may have existed, cannot be supposed to have affected the results deduced from so many observations.

The zenith distance of α Aquilæ being 45° the observations may be supposed to have been affected by the irregularities of refraction, which there is reason to suppose become, so far from the zenith, considerable in respect to the small quantities which are the objects of our research. However, it might also be supposed these effects would disappear in the results deduced from so many observations; but it is to be considered, that *four* unknown quantities are to be found from these observations.

Another important circumstance is to be taken into account, that the same irregularity of refraction takes place in four observations of the same day; this therefore reduces the above number of observations to the number of days, as far as refraction is concerned. This must have considerable effect as to the values of z, x, p, and e, in the four resulting equations. In consequence it is my intention in future, as to this star, to endeavour to increase the number of days of observation, and take only two observations on the same day.

In my paper in the Phil. Trans. 1821, I mentioned a difficulty, as to stars of considerable zenith distance, that occurred respecting the internal and external Thermometer, and stated my reasons for adhering to the use of the internal Thermometer. In the present case, it seemed desirable to examine the effects of computing the refraction by the external Thermometer, and the importance of the result appeared sufficient to compensate for the length of the calculation. The last terms of the above four equations were changed into

1. $+143{,}86$
2. $-44{,}8546$
3. $-60{,}8347$
4. $-168{,}6283$

Then

$$z = +0'',9860$$
$$p = +1{,}4218$$
$$x = +0{,}7689$$
$$e = -0{,}2921$$

Nothing is here gained as to the value of z, and therefore the use of the internal Thermometer cannot have occasioned the difficulty.

In consequence of these values of z, for the present it appears better to suspend all conclusions as to the values of p and the con-

stant of aberration for this star, although it by no means follows, that the values given by the *three* equations are considerably erroneous.

The *three* equations are

1. $395e+58,43x-7,77p-50,83=0$
2. $58,43e+64,9925x+18,9386p-92,7675=0$
3. $-7,77e+18,9386x+40,9277p-81,6417=0$

And

$$p=+1'',5544$$
$$x=+0,9588$$
$$e=+0,0175$$

If we suppose $x=0$ or the constant of aberration $=20'',25$ as to this star, as was done in the computation of the observations in the 12th Volume of the Transactions of the Academy, the equations are reduced to

$$395e-7,77p-50,83=0$$
$$-7,77e+40,9277p-81,6417=0$$
and $p=2'',03$ or $2p=4''$

This value of p shews, that the results of the new series of observations do not appear to differ materially from those in the 12th Volume above cited, when it is considered that many of those observations were made when the coefficients of p were very small (in this star it never exceeds, 52). This coincidence between the present results and the former result seems to imply a constant cause for the discordance, such as that of parallax; or perhaps that which is thought to be an irregularity of refraction, may follow some law hereafter to be discovered.

Notwithstanding the numerous observations of this star that have been made here, it is obvious a much greater number

will be required to clear up the difficulties that have occurred as to this and other low stars. It is my intention to pursue the subject. If an opportunity should be afforded me, by continuing the observations, of ultimately succeeding, I hope it will be considered that the time consumed has not been mispent.

As to the parallaxes of stars near the zenith, there cannot I think be a doubt, that they have been determined by this enquiry to the exactness of a small fraction of a second.

Table I. Containing the observations and reductions of α Lyræ almost explains itself.

The observations from the commencement to September 20, 1819, were all made on the meridian. The mean of the three microscopes being taken, and the correction for collimation or index error being applied, and also the sum of the equations, the mean zenith distance Jan. 1, 1819, is obtained. The refraction is computed by the internal Thermometer.

The corrections of the mean of the three microscopes, for collimation or index error, were as follows for the *single* observations:

				Face W.
1818	July 14	———	Aug. 16	+54,76
1818	Oct. 16	———	Nov. 8	+47,81
1818	Nov. 24	—1819,	Feb. 24	+43,67
1819	July 3	———	Augt. 27	+46,91
1819	Aug. 31	———	Nov. 8	+46,35

The marks ** in the dates signify, that the error of collimation was changed at that time.

The amount of the correction for the mean of the three microscopes was not changed between the 17th and 19th October 1818; but the relative position of the right and left microscopes was changed, in consequence of an adjustment of the horizontal axis of the circle.

From September 20, 1819, with the exception of a few observations, the observations were made off the meridian. One observation was made a few minutes before the time of coming to the meridian, and the other after the passage over the meridian, the instrument having been reversed. The position of the face of the instrument, whether east or west, is marked with the reading of the bottom microscope.

This method of observing off the meridian is considered to have rendered the observations more exact.

The zenith distance is obtained by the mean, without any correction for collimation, and without danger of a change in collimation, from an interval of some days having occurred.

This method adds considerably to the trouble of computation, but that is of no consequence compared with the other advantages.

I prefer making the computation of the corrections by Logarithms to taking the numbers out of a table.—If P be the distance in time from the meridian reduced to seconds, then in Lat. 53°.23′13″,5.

log. 1st. corr. = 6,51230 + log. sin. N. P. D. + cosec. Z. D. + 2 log P

log. 2d. corr. = 7,1564 + log. sin. N. P. D. + cosec. Z. D. + 4 log P

log. 3d. corr. = 2 log. 1st. corr. + 4,38454 + cotan. Z. D.

(Above Pole) Mer. Z. D. = observation—(1st corr—2d corr—3d corr.)

(Below Pole) Mer. Z. D. = observation + (1st corr—2d corr + 3d corr.)

The 2d and 3d corrections are very small, and may easily be con-

tained in a small table for a given star. The 2d correction is introduced on account of taking out in the first correction the log of P instead of the log sin of P reduced to seconds of space. This method somewhat facilitates the computation.

Table II. Contains the equations of condition for finding e, x, p, & z. The column of mean zenith distance, Table I. is to be corrected by taking away the solar nutation, which is found with a contrary sign in Table III. To this quantity so corrected are applied the parallax, correction of aberration, and solar nutation, found in terms of p, x, and z, by help of Table III. where the coefficients of those quantities are given. The result is equal to $14°.45'56'',41-e$.

Thus, for Aug. 1, 1821, Tab. I. M. Z. Dist. $14° 45'55'',81$
Tab. III. Solar Nut. $-0,17$

$$14° 45'55'',64+,48x+,74p+,35z$$
$$=14° 45'56'',41-e$$

Hence, $e+,48x+,74p+,35z-0,77=0$ vid. Aug. 1, 1821, Tab. II.

Table III. Is given principally to facilitate the formation of the equations of condition. The solar nutation used is put down with a contrary sign, and therefore, being applied to the sum of the equations in Table I. the result does not contain the solar nutation.

TABLE I.

Observations and reductions of the Zenith Distances of α Lyræ.

Date of observation	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope	Right hand Micr.	Sum of Equations	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1818		′ ″	° ′ ″	′ ″	″	° ′ ″			
July 14	- -	45 8,2	14 44 55,4 W	44 23,4	+ 10,74	14 45 54,50	30,10	65	59
15	- -	46 20,7	14 46 32,4 E	47 3,6	10,89	55,03	30,05	67¼	64
16	- -	45 8,4	14 44 55,9 W	44 23,4	11,12	55,11	30,00	69	65
17	- -	45 5,4	14 44 53,0 W	44 21,0	11,39	52,62	29,87	66	60
19	- -	46 18,3	14 46 29,5 E	47 1,0	12,15	53,66	29,89	59	50
24	- -	46 19,3	14 46 31,0 E	47 2,0	13,08	55,75	29,57	67	62½
25	- -	46 14,5	14 46 28,0 E	47 0,1	13,54	52,98	29,54	60½	53
27	- -	45 3,7	14 44 51,7 W	44 19,5	14,26	53,99	29,97	60	51½
Aug. 1	- -	46 17,0	14 46 28,3 E	47 2,2	15,45	56,52	29,97	61¼	55
2	- -	45 2,0	14 44 52,8 W	44 19,5	15,65	55,18	29,83	61	57
6	- -	46 12,5	14 46 24,5 E	46 59,0	16,53	53,77	29,94	62½	55
7	- -	45 3,5	14 44 52,6 W	44 20,0	16,80	56,93	29,86	60	55
9	- -	45 2,5	14 44 51,6 W	44 18,3	17,29	56,18	29,83	57½	50
10	- -	46 13,1	14 46 25,6 E	46 58,2	17,56	55,10	29,94	58	53
11	- -	45 0,8	14 44 49,6 W	44 17,6	17,79	55,22	29,99	58	53
12	- -	46 14,5	14 46 25,8 E	46 57,8	18,00	55,94	29,97	58	53
13	- -	45 0,0	14 44 49,5 W	44 16,5	18,21	54,97	30,00	59	53
14	- -	46 13,0	14 46 25,3 E	46 57,7	18,36	55,60	30,00	59¼	53½
15	- -	45 0,3	14 44 49,2 W	44 15,3	18,54	54,90	29,98	59¼	53
** 16	- -	46 13,5	14 46 24,2 E	46 56,2	18,67	55,21	29,93	60	54
Oct. 16	- -	45 7,0	14 44 54,8 W	44 20,2	22,37	57,51	29,62	57	53½
** 17	- -	46 4,7	14 46 17,1 E	46 50,1	22,39	58,55	29,77	56	54
19	- -	44 48,6	14 44 52,3 W	44 37,0	22,11	55,89	29,57	56	55
20	- -	46 20,0	14 46 14,4 E	46 30,0	22,06	55,72	29,75	58	57
26	- -	46 22,3	14 46 17,7 E	46 32,5	21,51	57,87	29,75	54¼	55
Nov. 2	- -	44 51,4	14 44 55,8 W	44 39,5	20,37	57,08	29,40	56	54
3	- -	46 21,0	14 46 15,7 E	46 33,1	20,18	55,64	29,27	55	52
7	- -	46 21,7	14 46 18,0 E	46 33,4	19,75	56,31	29,48	50	49¼
8	- -	44 52,3	14 44 56,3 W	44 39,4	19,62	56,76	29,61	50	50
** 24	- -	44 56,2	14 44 59,5 W	45 0,0	16,09	58,33	29,47	51½	49½
Dec. 5	- -	46 27,1	14 46 24,0 E	46 28,7	13,38	56,31	29,12	42	39
7	- -	45 0,6	14 45 3,5 W	45 1,0	12,65	58,02	29,03	46	44
9	- -	46 29,8	14 46 26,3 E	46 29,0	12,60	57,30	29,81	43	42
15	- -	45 1,6	14 45 2,0 W	44 57,3	10,95	54,92	29,83	40	36½
16	- -	46 30,7	14 46 29,6 E	46 31,7	10,68	57,68	29,83	39	39

α Lyræ.

Date of observation	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm.	
								Int.	Ext.
1818		′ ″	° ′ ″	′ ″	″	° ′ ″			
Dec. 21	- -	45 1,5	14 45 3,3 W	44 59,0	+ 9,04	14 45 53,98	29,94	45	42½
22	- -	45 3,6	14 45 4,8 W	45 1,8	8,94	56,01	30,16	42	41
1819									
Jan. 8	- -	45 10,0	14 45 14,7 W	45 12,5	2,56	58,63	28,84	44	44
10	- -	46 39,6	14 46 34,8 E	46 37,2	2,28	55,81	29,25	40	39
11	- -	45 7,7	14 45 12,8 W	45 10,2	2,07	55,97	29,57	42½	46
12	- -	46 40,0	14 46 35,9 E	46 39,2	1,80	56,50	29,54	41	38
17	- -	45 12,3	14 45 15,0 W	45 12,6	0,34	57,31	29,42	37	36
18	- -	46 40,8	14 46 37,5 E	46 40,8	+ 0,03	56,06	29,46	37½	40½
19	- -	45 13,3	14 45 16,4 W	45 13,7	— 0,26	57,88	29,25	34	34
20	- -	46 41,4	14 46 38,8 E	46 42,0	0,63	56,43	29,20	35	34½
25	- -	46 42,2	14 46 40,0 E	46 43,4	2,09	56,11	29,06	34	33
29	- -	45 15,6	14 45 19,8 W	45 15,8	3,28	57,46	29,17	38	39½
31	- -	45 15,5	14 45 18,3 W	45 14,9	3,57	56,33	29,31	32½	30
Feb. 1	- -	46 42,4	14 46 40,9 E	46 45 8	3,69	55,67	29,37	30	27½
5	- -	45 17,7	14 45 20,0 W	45 17,0	5,11	56,79	29,19	39	40
6	- -	45 18,5	14 45 20,7 W	45 17,0	5,30	57,10	29,07	35½	35
9	- -	46 47,3	14 46 44,2 E	46 48,1	5,87	56,99	29,49	37	36
21	- -	46 49,1	14 46 45,7 E	46 49,0	8,16	56,10	29,72	37½	35
24	- -	45 21,5	14 45 24,0 W	45 20,5	— 8,51	57,16	29,72	33	30
July 3	- -	46 30,9	14 46 27,4 E	46 31,7	+ 9,37	52,46	29,48	56½	51
4	- -	44 58,3	14 45 1,7 W	44 57,4	9,69	55,73	29,54	56	51
** 14	- -	46 27,4	14 46 23,2 E	46 34,9	12,56	54,15	29,89	63	57
15	- -	44 55,9	14 45 1,4 W	44 50,7	12,70	55,61	29,87	64½	58½
20	- -	46 26,5	14 46 23,2 E	46 34,7	14,24	55,46	29,48	55	47½
21	- -	44 54,4	14 45 0,0 W	44 49,0	14,52	55,90	29,76	59	53
24	- -	46 26,1	14 46 21,7 E	46 33,6	15,32	55,54	29,90	63	57
28	- -	44 50,2	14 44 56,0 W	44 45,1	16,39	53,78	30,03	63½	56
29	- -	46 24,1	14 46 20,0 E	46 31,8	16,56	54,95	29,96	64	59
30	- -	44 50,3	14 44 56,0 W	44 45,0	16,72	54,06	29,98	66	60
Aug. 2	- -	44 50,0	14 44 55,9 W	44 45,2	17,40	54,68	29,80	67	61
4	- -	46 23,1	14 46 18,5 E	46 29,3	17,92	54,64	29,79	64½	57½
7	- -	44 47,8	14 44 54,7 W	44 43,4	18,61	54,15	29,85	65	58
9	- -	46 22,9	14 46 18,0 E	46 29,4	19,05	55,57	29,91	66	59
15	- -	44 44,6	14 44 51 0 W	44 40,1	20,32	52,46	29,92	66	62
18	- -	46 21,8	14 46 16,5 E	46 27,3	20,89	55,85	30,09	67½	61

α Lyræ.

Date of observation.	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean. Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1819	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
Aug. 19	- -	44 46,3	14 44 53,3W	44 43,4	+ 21,03	14 45 55,61	30,01	68	61½
21	- -	46 20,6	14 46 15,0 E	46 25,5	21,44	54,90	29,98	66	59
23	- -	44 46,4	14 44 52,0W	44 40,7	21,76	55,04	29,97	67½	61
27	- -	46 17,9	14 46 12,7 E	46 22,0	22,40	52,02	29,80	63	58
31	- -	44 50,0	14 44 52,8W	44 40,7	22,96	57,14	29,15	53	47
Sept. 8	- -	44 48,4	14 44 52,5W	44 40,8	23,84	57,42	29,79	64½	61½
10	- -	44 46,4	14 44 52,0W	44 41,6	24,23	57,25	29,91	60½	54
Sept. 12	- -	46 17,2	14 46 11,6 E	46 21,9	24,48	55,03	30,03	61	57
14	- -	46 14,2	14 46 9,6 E	46 21,0	24,56	53,14	29,93	62	55½
16	- -	44 44,5	14 44 50,2W	44 38,6	24,91	55,69	29,82	52½	47
20	5 23,4	48 0,6	14 48 0,7 E	48 15,1	25,29	56,91	30,22	55	48
	1 41,6	44 51,9	14 44 57,6W	44 47,4					
21	- -	46 15,0	14 46 10,5 E	46 23,0	25,28	55,10	30,25	55	49½
22	- -	44 43,0	14 44 49,0W	44 38,2	25,32	55,07	30,12	55½	50
23	- -	44 44,3	14 44 48,4W	44 38,3	25,22	55,24	29,83	56	51
Oct. 2	5 35,9	46 36,0	14 46 41,3W	46 30,7	25,00	55,84	29,28	59½	57
	11 25,1	54 0,6	14 53 59,5 E	54 12,2					
4	4 45,2	46 5,3	14 46 10,2W	46 0,6	25,27	56,98	29,55	53½	46
	4 32,8	47 32,4	14 47 28,0 E	47 39,5					
17	- -	46 19,2	14 46 14,5 E	46 25,1	25,04	58,29	30,13	48½	46
20	2 26,3	45 6,5	14 45 10,2W	44 59,8	24,38	56,91	29,40	50	47
	4 12,7	47 21,8	14 47 19,8 E	47 32,1					
29	- -	46 18,0	14 46 16,2 E	46 29,2	23,70	58,48	29,50	41	41
30	- -	44 48,8	14 44 52,1W	44 40,3	23,59	57,01	29,70	43½	44
Nov. 2	- -	46 17,5	14 46 16,2 E	46 30,1	23,13	58,05	29,57	43½	42½
8	- -	44 48,6	14 44 52,8W	44 41,1	22,22	56,07	29,59	40	38½
Dec. 13	3 8,3	45 33,6	14 45 35,6W	45 24,5	14,07	56,73	29,68	36	34
	3 40,7	47 14,5	14 47 14,1 E	47 25,4					
15	3 49,9	45 52,1	14 45 53,4W	45 41,3	13,30	56,67	29,27	35	35
16	2 49,5	46 55,7	14 46 56,0 E	47 9,3	13,23	56,60	29,59	33½	36½
	4 43,5	46 18,0	14 46 20,9W	46 10,3					
	10 33,3	51 34,2	14 51 36,7W	51 26,5					
23	2 36,3	46 54,9	14 46 54,0 E	47 4,6	10,67	57,26	29,14	39	36

α Lyræ.

Date of observation.	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1819	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
Dec. 26	6 55,8	47 58,7	14 47 58,4W	47 46,2	+ 9,94	14 45 58,33	29,15	34½	32
	3 42,3	45 54,1	14 45 55,6W	45 43,2					
	3 39,7	47 17,1	14 47 19,4 E	47 33,6					
	6 10,2	48 45,0	14 48 46,3 E	49 0,5					
29	4 45,5	46 27,5	14 46 28,2W	46 17,2	9,36	58,45	29,53	30	26
	4 3,5	47 30,0	14 47 30,1 E	47 42,5					
30	5 26,6	46 53,8	14 46 54,5W	46 41,5	8,45	58,64	29,07	32	31
	5 26,7	48 17,2	14 48 18,9 E	48 33,0					
1820									
Jan. 2	4 13,1	47 35,7	14 47 37,7 E	47 49,6	7,92	58,33	29,58	27½	27
	4 51,4	46 30,1	14 46 32,0W	46 22,7					
5	5 29,3	46 57,1	14 46 56,8W	46 43,6	6,85	57,76	29,88	36½	37
	4 1,7	47 32,7	14 47 31,9 E	47 43,0					
15	3 17,8	47 16,4	14 47 16,4 E	47 27,3	3,90	58,24	29,50	27	26
	3 18,7	45 48,1	14 45 51,2W	45 41,8					
16	4 2,9	46 9,0	14 46 11,1W	46 0,3	+ 3,44	57,87	29,35	29	27
	3 12,6	47 14,5	14 47 13,6 E	47 25,5					
March 2	5 7,4	48 20,2	14 48 22,3 E	48 36,2	— 6,74	57,15	29,80	30½	27
	4 44,1	46 37,1	14 46 40,7W	46 30,5					
8	0 30,7	45 19,5	14 45 22,8W	45 11,0	7,61	56,89	29,83	37	36
	6 56,3	49 39,8	14 49 40,8 E	49 53,5					
19	0 52,4	46 53,3	14 46 52,2 E	47 4,3	8,15	55,75	30,05	37	29
	7 19,6	48 26,5	14 48 30,7W	48 21,5					
22	1 11,4	46 54,2	14 46 53,8 E	47 6,5	8,77	56,10	29,00	39	37
	7 31,6	48 40,5	14 48 43,8W	48 34,5					
24	2 57,3	47 20,5	14 47 20,3 E	47 33,0	8,53	56,35	29,04	34	31
	9 48,1	51 1,4	14 51 5,1W	50 54,1					
25	0 1,0	46 50,3	14 46 49,8 E	47 2,3	8,68	57,30	29,17	40	42
	7 48,0	48 57,3	14 49 0,4W	48 49,8					
April 5	4 54,1	46 44,7	14 46 47,2W	46 37,3	8,33	55,62	29,00	40	35
	5 43,6	48 43,1	14 48 44,7 E	48 58,0					
6	3 30,1	47 31,6	14 47 31,5 E	47 44,2	— 8,03	55,51	29,10	35	29½
	7 19,9	48 28,8	14 48 32,3W	48 22,5					
July 5	5 13,4	46 36,4	14 46 39,4W	46 28,9	+ 13,36	57,05	29,92	58	50
	3 35,6	47 15,7	14 47 11,8 E	47 22,6					

α *Lyræ.*

Date of observation		Time of ob. from passage over mer	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1820		′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
July	7	5 19,0	46 35,4	14 46 39,6 W	46 29,5	+ 13,98	14 45 55,57	30,00	58¼	50
		6 20,5	48 50,4	14 48 49,1 E	49 2,2					
	8	4 58,1	47 56,5	14 47 54,4 E	48 8,8	14,18	55,71	29,90	59	51½
		1 4,9	44 54,4	14 45 1,3 W	44 52,0					
	10	6 9,7	47 11,1	14 47 16,0 W	47 4,8	14,67	56,09	29,80	61	54
		1 22,3	46 33,8	14 46 30,0 E	46 41,4					
	13	4 53,6	47 52,7	14 47 51,0 E	48 3,1	15,46	55,80	29,64	61	54
		4 2,4	45 48,1	14 45 54,7 W	45 45,9					
	15	5 22,2	46 32,6	14 46 37,7 W	46 27,5	16,03	54,81	29,70	61½	55
		1 16,8	46 33,9	14 46 29,2 E	46 39,7					
	18	6 52,2	49 16,2	14 49 14,0 E	49 27,2	16,63	56,88	29,20	60½	53
		3 44,8	45 39.5	14 45 46,0 W	45 37,3					
	19	4 43,0	46 10,0	14 46 15,7 W	46 5,6	16,99	57,08	29,40	61	55
		1 7,0	46 32,3	14 46 28,5 E	46 41,3					
	24	6 12,0	47 6,2	14 47 12,0 W	47 1,5	18,51	56,18	29,65	59	55
		3 6,0	47 0,3	14 46 56,0 E	47 6,9					
	25	5 26,0	48 9,2	14 48 7,7 E	48 21,2	18,83	56,10	29,69	58	53
		3 27,5	45 30,6	14 45 35,7 W	45 25,7					
Sept.	12	2 29,1	45 2,3	14 45 6,2 W	44 54,6	27,49	56,90	29,77	65½	61
		3 58,4	47 16,2	14 47 11,1 E	47 22,6					
	15	5 34,2	46 31,4	14 46 34,7 W	46 23,9	27,75	56,17	29,52	59	54
		0 54,8	46 20,0	14 46 16,0 E	46 27,4					
	18	3 6,4	46 51,5	14 46 48,3 E	46 59,5	28,21	56,53	29,60	51	44
		4 5,6	45 40,3	14 45 43,0 W	45 31,7					
	20	3 16,9	45 20,3	14 45 23,3 W	45 11,3	28,11	56,03	29,21	52	48
		3 15,1	46 51,7	14 46 49,1 E	47 1,7					
Oct.	4	5 58,0	48 19,8	14 48 19,5 E	48 32,9	28,84	56,81	30,27	53	50
		1 26,0	44 48,5	14 44 52,2 W	44 40,1					
	5	0 55,0	46 18,0	14 46 15,2 E	46 27,1	28,80	57,51	30,15	51	49
		5 27,0	46 28,8	14 46 31,8 W	46 20,1					
	18	4 9,4	45 46,1	14 45 48,9 W	45 36,9	27,65	57,41	29,02	47	46
		3 12,6	46 53,0	14 46 49,7 E	47 1,0					
	25	0 44,9	44 46,1	14 44 48,5 W	44 37,4	27,09	56,99	29,10	45	44
		6 36,6	48 50,7	14 48 49.3 E	49 3,4					
Nov.	1	4 40,3	46 2,7	14 46 5,0 W	45 52,7	26,31	56,67	29,27	44	42
		2 40,2	46 42,3	14 46 39,9 E	46 51,3					
	2	3 42,8	45 32,7	14 45 35,8 W	45 24,2	26,21	56,04	29,45	46	44
		3 25,2	46 58,6	14 46 56,0 E	47 6,2					

α Lyræ.

Date of observation	Time of ob. from passage over mer	Left hand Micr.	Bottom Microscope	Right hand Micr.	Sum of Equations	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1820	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
Dec. 2	4 51,3	46 17,4	14 46 18,5 W	46 6,1	+ 20,15	14 45 57,65	29,70	42	42
	5 59,2	48 29,3	14 48 29,9 E	48 43,0					
11	1 43,4	45 4,0	14 45 7,0 W	44 56,7	17,32	57,41	29,54	49	48
19	3 52,6	45 49,0	14 45 52,8 W	45 42,7	15,21	57,81	29,92	47	48
	3 15,9	47 8,1	14 47 5,1 E	47 14,5					
23	3 30,7	47 14,0	14 47 10,9 E	47 21,1	13,99	56,53	29,71	45½	45
	2 12,8	45 11,8	14 45 16,5 W	45 6,5					
28	4 10,4	47 32,9	14 47 31,2 E	47 41,4	12,80	57,72	29,69	35½	34
	3 13,6	45 36,0	14 45 39,2 W	45 28,4					
1821									
Jan. 2	2 9,8	46 45,5	14 46 45,1 E	46 56,0	10,79	57,86	29,21	33	32½
	6 15,7	47 26,0	14 47 27,2 W	47 14,7					
13	4 34,9	46 23,8	14 46 26,0 W	46 14,8	7,27	57,70	29,41	41	40
	2 26,6	46 54,2	14 46 52,3 E	47 1,7					
19	4 39,6	46 29,5	14 46 31,1 W	46 18,8	5,72	57,14	30,04	44	42½
	2 20,4	46 53,0	14 46 50,1 E	46 58,7					
Feb. 1	4 37,9	47 52,0	14 47 49,4 E	48 0,5	2,20	55,79	29,96	43	40
	3 17,1	45 50,3	14 45 53,3 W	45 43,1					
2	4 53,6	46 40,6	14 46 42,2 W	46 30,3	1,88	56,38	29,89	44	44
	0 3,6	46 34,8	14 46 32,8 E	46 44,0					
6	3 0,2	45 46,8	14 45 50,7 W	45 38,8	1,04	56,59	30,14	43	45
	4 38,8	47 53,7	14 47 51,6 E	48 1,2					
8	1 52,5	46 50,2	14 46 47,8 E	46 58,1	0,50	57,46	29,97	42½	41
	3 29,5	46 0,0	14 46 2,8 W	45 52,0					
10	3 51,7	47 28,7	14 47 29,5 E	47 39,7	+ 0,32	57,07	30,06	37	33
	3 4,0	45 49,1	14 45 52,7 W	45 42,5					
14	4 28,8	46 32,8	14 46 33,3 W	46 21,6	— 0,36	58,50	30,17	34½	32
	1 14,2	46 43,7	14 46 42,1 E	46 52,1					
19	4 37,7	46 33,7	14 46 35,7 W	46 23,8	1,26	55,66	30,07	31	30
	3 20,3	47 16,7	14 47 15,5 E	47 26,6					
24	4 15,1	47 45,2	14 47 43,8 E	47 54,2	2,34	58,02	29,76	34	30
	1 52,4	45 32,6	14 45 34,2 W	45 24,5					
27	5 2,6	46 52,5	14 46 53,8 W	46 41,8	3,17	56,28	29,00	33	30
	3 26,1	47 20,1	14 47 19,2 E	47 30,0					
March 9	3 41,5	46 10,8	14 46 14,8 W	46 3,1	4,62	56,96	29,05	44½	45
	4 14,5	47 46,3	14 47 42,3 E	47 52,5					
10	4 34,0	46 36,5	14 46 38,3 W	46 27,3	4,41	56,67	29,43	41	38½
	3 50,5	47 33,5	14 47 31,8 E	47 42,3					

α Lyræ.

Date of observation.	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1821	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
March 11	2 46,2	47 8,1	14 47 6,5 E	47 17,4	— 4,39	14 45 56,45	29,56	41	38
	4 28,8	46 32,6	14 46 34,3 W	46 24,7					
12	2 0,9	45 33,2	14 45 36,6 W	45 25,0	4,50	56,13	29,60	43½	44
	4 42,1	48 2,3	14 47 59,3 E	48 9,0					
13	3 8,5	47 17,5	14 47 16,7 E	47 26,6	4,18	57,74	29,90	37	31
	3 22,0	46 2,3	14 46 3,7 W	45 53,0					
15	3 30,6	46 6,6	14 46 7,7 W	45 56,2	4,32	57,84	29,87	37½	34
	2 51,4	47 11,5	14 47 10,4 E	47 21,1					
19	2 7,4	45 43,7	14 45 40,0 W	45 28,5	4,80	57,80	29,21	35½	35
	4 14,1	47 46,1	14 47 44,3 E	47 54,5					
21	4 17,6	47 48,2	14 47 46,6 E	47 58,1	4,55	58,06	29,61	34	31
	1 47,4	45 34,5	14 45 36,1 W	45 25,0					
22	1 2,4	45 26,4	14 45 28,5 W	45 16,5	— 4,44	56,93	29,75	33½	31
	5 28,6	48 28,0	14 48 26,0 E	48 37,1					
July 6	4 48,3	46 19,4	14 46 23,7 W	46 12,6	+ 17,64	55,58	29,73	54	46
	1 22,7	46 27,1	14 46 22,0 E	46 31,8					
10	5 50,9	48 22,8	14 48 19,6 E	48 31,2	18,87	55,51	29,98	57	51½
	0 9,1	44 51,1	14 44 56,5 W	44 46,9					
11	5 59,3	48 28,0	14 48 23,9 E	48 35,0	19,17	56,09	29,89	56½	49½
	3 40,7	45 41,3	14 45 47,3 W	45 37,5					
13	5 13,4	46 30,5	14 46 35,3 W	46 25,3	19,61	56,29	29,66	57	52
	3 5,6	46 56,0	14 46 50,2 E	46 59,5					
18	5 22,3	48 2,7	14 47 59,8 E	48 12,0	21,07	57,76	29,93	59	54
	3 53,7	45 45,3	14 45 51,5 W	45 42,7					
20	5 16,2	46 29,7	14 46 33,9 W	46 22,3	21,33	55,38	29,35	59	56
	1 16,8	46 24,5	14 46 19,8 E	46 30,6					
23	4 29,7	46 1,2	14 46 5,7 W	45 55,0	22,12	55,30	29,25	58	53½
	1 39,8	46 27,2	14 46 22,9 E	46 34,4					
25	5 4,3	47 51,3	14 47 46,0 E	47 56,9	22,75	57,80	29,48	58	54
27	4 16,9	47 23,8	14 47 18,3 E	47 29,5	23,36	55,48	29,79	60	54
	1 57,1	45 0,0	14 45 5,3 W	44 54,2					
Aug. 1	3 40,9	47 6,9	14 46 59,8 E	47 9,8	24,53	55,81	29,76	63	57
	1 48,1	44 56,1	14 45 2,3 W	44 53,7					

α Lyræ.

Date of observation.	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean. Z. Dist. Jan. 1, 1819.	Bar.	Therm. Int.	Therm. Ext.
1821	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
Aug. 2	5 56,7	46 53,3	14 46 58,2W	46 48,1	+ 24,93	14 45 55,68	29,86	61	55
	2 29,8	46 37,3	14 46 31,8 E	46 43,2					
4	2 10,1	46 32,0	14 46 25,9 E	46 35,2	25,16	55,10	29,70	65	60½
	4 41,9	46 3,2	14 46 10,0W	46 1,6					
14	3 19,4	45 21,7	14 45 27,7W	45 17,9	27,44	55,08	29,61	61½	58
	3 52,6	47 5,8	14 47 0,9 E	47 12,6					
16	3 19,8	46 51,9	14 46 46,7 E	46 57,9	27,95	56,16	29,77	60	57
	3 41,2	45 31,2	14 45 37,5W	45 29,8					
23	2 5,2	46 24,1	14 46 18,0 E	46 28,2	29,11	54,46	29,73	64½	60
	5 12,8	46 18,1	14 46 25,6W	46 17,5					
24	5 35,3	46 36,1	14 46 43,6W	46 34,4	29,14	57,17	29,67	67	62
	4 8,7	47 13,8	14 47 5,8 E	47 15,5					
Sept. 3	2 27,4	45 0,7	14 45 7,5W	44 58,2	30,57	55,46	29,50	66	63
	4 23,1	47 20,0	14 47 12,6 E	47 22,4					
9	1 23,2	44 45,0	14 44 52,7W	44 42,9	31,30	55,44	29,24	59	56
	5 5,3	47 42,2	14 47 35,9 E	47 45,5					
12	3 13,4	45 17,3	14 45 24,3W	45 11,4	31,82	55,98	29,57	58	54
	4 31,1	47 23,0	14 47 16,2 E	47 24,4					
22	5 11,7	47 46,2	14 47 39,8 E	47 50,5	32,44	57,12	29,58	59	53½
	2 52,3	45 9,1	14 45 15,5W	45 6,3					
26	4 43,8	46 1,3	14 46 6,3W	45 56,6	32,45	57,20	29,50	60	57
	2 25,2	46 30,4	14 46 24,6 E	46 33,2					
27	2 40,3	46 33,9	14 46 27,9 E	46 38,2	32,61	56,04	29,62	57	52
	3 33,7	45 24,2	14 45 29,7W	45 20,2					
28	2 44,0	46 34,0	14 46 29,3 E	46 38,5	32,28	55,75	28,92	57	54
	4 29,0	45 51,7	14 45 57,0W	45 47,2					
29	2 56,0	45 11,7	14 45 15,2W	45 5,0	32,68	56,26	29,40	52	47½
	3 36,0	46 53,5	14 46 49,2 E	46 59,1					
Oct. 1	2 25,2	46 29,4	14 46 24,3 E	46 34,8	32,83	57,16	29,72	54	50½
	2 47,8	45 8,4	14 45 12,6W	45 3,8					
8	2 4,7	44 57,4	14 45 1,1W	44 51,7	32,68	57,04	29,81	56	52
	4 53,3	47 33,7	14 47 28,5 E	47 37,5					
14	1 19,4	44 47,0	14 44 51,5W	44 41,3	32,67	56,44	30,05	52	48
	4 11,6	47 10,5	14 47 5,5 E	47 15,0					
23	5 11,5	47 46,3	14 47 40,8 E	47 50,6	31,42	57,57	28,92	51	49
	1 43,5	44 53,3	14 44 58,5W	44 49,5					

α *Lyræ.*

Date of observation.	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope.	Right hand Micr.	Sum of Equations.	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm.	
								Int.	Ext.
1821	′ ″	′ ″	o ′ ″	′ ″	″	o ′ ″			
Oct. 29	3 27,2	45 25,5	14 45 31,0 W	45 21,7	+ 30,96	14 45 56,30	29,82	56½	53
	3 1,8	46 40,2	14 46 36,0 E	46 44,9					
Nov. 27	4 22,8	45 57,5	14 46 2,0 W	45 52,0	25,69	56,11	29,34	42	39
	5 6,7	47 46,1	14 47 41,8 E	47 50,8					
28	4 33,4	47 30,7	14 47 26,0 E	47 35,0	25,20	57,58	29,20	47	47½
	3 10,6	45 24,5	14 45 29,5 W	45 20,7					
29	2 40,0	46 40,8	14 46 36,7 E	46 46,0	25,07	57,08	29,32	45⅓	44
	4 25,5	45 58,3	14 46 3,1 W	45 54,5					
Dec. 3	4 46,9	47 36,4	14 47 33,0 E	47 43,5	24,18	57,12	29,36	43	40½
	2 46,1	45 17,5	14 45 22,5 W	45 13,3					
5	4 30,8	46 5,7	14 46 10,3 W	46 0,2	23,68	57,64	29,49	43	43½
	2 26,7	46 37,0	14 46 32,7 E	46 41,5					
6	5 27,7	48 3,0	14 47 59,0 E	48 8,8	23,66	58,45	29,80	40½	42
	1 25,3	44 59,8	14 45 4,7 W	44 56,2					
11	4 18,7	47 24,4	14 47 20,3 E	47 28,9	22,22	57,15	29,88	44½	42
	3 57,3	45 47,2	14 45 52,5 W	45 44,8					
17	5 39,4	46 51,0	14 46 55,2 W	46 46,8	19,90	57,46	28,92	47	45
	3 45,6	47 10,0	14 47 5,5 E	47 13,3					
21	4 31,0	47 35,0	14 47 30,2 E	47 38,4	18,76	57,99	28,88	44½	43½
	2 19,0	45 15,2	14 45 20,7 W	45 13,3					
24	5 8,4	46 34,0	14 46 36,9 W	46 28,5	17,81	57,50	28,39	38½	38
	2 18,6	46 39,8	14 46 36,3 E	46 44,4					
26	4 50,5	46 23,6	14 46 26,6 W	46 18,2	17,18	57,12	28,20	35½	34
	2 48,0	46 49,6	14 46 46,0 E	46 52,4					
30	4 14,9	46 4,4	14 46 9,0 W	45 58,5	16,34	56,91	29,78	40½	39
	2 26,1	46 43,0	14 46 39,5 E	46 47,2					
31	3 29,9	47 8,3	14 47 4,0 E	47 12,0	15,83	57,42	29,38	41	40
	3 45,6	45 48,9	14 45 54,3 W	45 46,0					
1822									
Jan. 1	4 39,4	47 42,5	14 47 38,5 E	47 46,6	15,70	58,63	29,53	38	37½
	3 11,1	45 36,9	14 45 41,7 W	45 34,0					
4	2 16,8	45 21,4	14 45 24,5 W	45 15,6	15,11	57,50	29,92	34	35
	3 4,2	46 56,7	14 46 53,7 E	46 59,9					
5	0 0,5	45 5,8	14 45 6,0 W	44 56,4	14,73	57,45	29,92	36½	37
	5 31,5	48 10,6	14 48 8,7 E	48 17,3					

α Lyræ.

Date of observation	Time of ob. from passage over mer.	Left hand Micr.	Bottom Microscope	Right hand Micr.	Sum of Equations	Mean Z. Dist. Jan. 1, 1819.	Bar.	Therm.	
								Int.	Ext.
1822	′ ″	′ ″	° ′ ″	′ ″	″	° ′ ″			
Jan. 6	1 44,6	46 35,0	14 46 32,5 E	46 42,3	+ 14,45	14 45 57,89	29,94	35½	37
	3 21,9	45 41,8	14 45 46,1 W	45 37,6					
16	3 31,9	47 41,5	14 47 38,0 E	47 46,9	11,35	57,89	30,02	40½	39
	2 9,6	45 19,9	14 45 25,8 W	45 18,4					
29	4 48,9	46 30,1	14 46 34,8 W	46 26,8	7,81	56,52	30,12	38½	35
	3 32,1	47 15,8	14 47 10,7 E	47 18,1					
30	2 53,9	47 2,8	14 46 58,1 E	47 6,8	7,42	56,72	29,95	40	40
	3 26,1	45 47,6	14 45 53,0 W	45 45,0					
Feb. 5	2 15,0	46 52,5	14 46 48,5 E	46 56,8	5,82	57,68	29,58	38	39
	3 12,5	45 45,2	14 45 50,5 W	45 43,0					
7	4 42,4	46 31,6	14 46 35,7 W	46 27,9	5,31	58,11	29,46	37	34
	3 15,1	47 11,5	14 47 7,1 E	47 15,3					
11	5 32,4	47 4,2	14 47 7,5 W	46 56,6	4,65	57,88	29,85	37	38
	0 40,6	46 33,9	14 46 31,5 E	46 40,8					
14	4 41,5	47 53,0	14 47 49,5 E	47 57,8	3,78	56,85	29,66	42	41
	2 46,5	45 38,3	14 45 43,7 W	45 35,9					
15	6 16,8	47 35,5	14 47 37,8 W	47 28,0	3,93	56,63	30,01	37	35
	2 10,2	46 49,3	14 46 46,6 E	46 54,0					

TABLE II.

α Lyræ.

Date of observation.	Equations of condition.	Date of observation.	Equations of condition.
1818		1819	
July 14	$e+,23x+,85p+,82\ z-2,31=0$	Jan. 17	$e-32x-,82p+68\ z+0,57=0$
15	$e+24x+84p+80\ z-1,77=0$	18	$e-34x-82p+66\ z-0,66=0$
16	$e+26x+84p+77\ z-1,67=0$	19	$e-36x-81p+63\ z+1,17=0$
17	$e+27x+83p+75\ z-4,15=0$	20	$e-37x-80p+61\ z-0,27=0$
19	$e+31x+82p+70\ z-3,09=0$	25	$e-43x-77p+45\ z-0,52=0$
24	$e+38x+79p+58\ z-0,94=0$	29	$e-49x-74p+32\ z+0,90=0$
25	$e+40x+79p+55\ z-3,69=0$	31	$e-51x-72p+26\ z-0,20=0$
27	$e+43x+77p+48\ z-2,65=0$	Feb. 1	$e-52x-71p+22\ z-0,85=0$
Aug. 1	$e+47x+74p+35\ z-0,06=0$	5	$e-57x-66p+09\ z+0,33=0$
2	$e+49x+74p+32\ z-1,38=0$	6	$e-58x-65p+05\ z+0,66=0$
6	$e+54x+70p+19\ z-2,73=0$	9	$e-62x-62p-05\ z+0,60=0$
7	$e+55x+70p+15\ z+0,44=0$	21	$e-73x-49p-45\ z-0,10=0$
9	$e+57x+66p+09\ z-0,27=0$	24	$e-75x-45p-54\ z+1,00=0$
10	$e+58x+65p+05\ z-1,34=0$	July 3	$e+09x+88p+96\ z-4,41=0$
11	$e+60x+64p+02\ z-1,20=0$	4	$e+10x+88p+94\ z-1,14=0$
12	$e+61x+63p-02\ z-0,47=0$	14	$e+23x+85p+82\ z-2,66=0$
13	$e+62x+62p-05\ z-1,60=0$	15	$e+24x+84p+80\ z-1,19=9$
14	$e+63x+61p-08\ z-0,77=0$	20	$e+32x+82p+68\ z-1,28=0$
15	$e+64x+60p-12\ z-1,46=0$	21	$e+34x+82p+66\ z-0,82=0$
16	$e+65x+59p-15\ z-1,13=0$	24	$e+38x+79p+58\ z-1,15=0$
Oct. 16	$e+84x-25p-77\ z+1,48=0$	28	$e+43x+77p+45\ z-2,90=0$
17	$e+84x-26p-75\ z+2,50=0$	29	$e+44x+76p+42\ z-1,66=0$
19	$e+82x-29p-70\ z-0,18=0$	30	$e+46x+75p+39\ z-2,54=0$
20	$e+82x-31p-68\ z-0,36=0$	Aug. 2	$e+49x+74p+32\ z-1,88=0$
26	$e+79x-41p-52\ z+1,71=0$	4	$e+51x+72p+26\ z-1,89=0$
Nov. 2	$e+74x-49p-32\ z+0,82=0$	7	$e+55x+70p+15\ z-2,34=0$
3	$e+73x-50p-29\ z-0,63=0$	9	$e+57x+66p+09\ z-0,88=0$
7	$e+69x-55p-15\ z-0,02=0$	15	$e+64x+60p-12\ z-3,90=0$
8	$e+67x-56p-12\ z+0,41=0$	18	$e+67x+57p-22\ z-0,46=0$
24	$e+48x-73p+45\ z+1,71=0$	19	$e+67x+55p-25\ z-0,68=0$
Dec. 5	$e+34x-81p+74\ z-0,45=0$	21	$e+69x+53p-32\ z-1,36=0$
7	$e+31x-82p+78\ z+1,24=0$	23	$e+71x+51p-39\ z-1,19=0$
9	$e+28x-82p+83\ z+0,50=0$	27	$e+75x+46p-49\ z-3,15=0$
15	$e+19x-86p+92\ z-1,92=0$	31	$e+78x+41p-62\ z+1,01=0$
16	$e+18x-86p+93\ z+0,83=0$	Sept. 8	$e+82x+31p-78\ z+1,38=0$
Dec. 21	$e+10x-88p+98\ z-2,90=0$	10	$e+84x+28p-83\ z+1,23=0$
22	$e+08x-88p+99\ z-0,87=0$	12	$e+85x+24p-87\ z-0,97=0$
1819 Jan. 8	$e-19x-85p+87\ z+1,79=0$	14	$e+85x+21p-90\ z-2,85=0$
10	$e-22x-85p+84\ z-1,01=0$	16	$e+86x+19p-92\ z-0,28=0$
11	$e-23x-84p+82\ z-0,84=0$	(2) 20	$e+88x+13p-96\ z+0,95=0$
12	$e-25x-84p+80\ z-0,30=0$	21	$e+87x+13p-97\ z-0,85=0$

α Lyræ.

Date of observation.		Equations of condition.	Date of observation.		Equations of condition.
1819			1820		
Sept. 22	1	$e+,88x+,10p-,98z-0,87=0$	July 19	2	$e+,31x+,82p+,70z+0,33=0$
23	1	$e+88x+08p-99z-0,70=0$	24	2	$e+38x+79p+58z-0,51=0$
Oct. 2	2	$e+88x-05p-97z-0,10=0$	25	2	$e+40x+79p+55z-0,57=0$
4	2	$e+88x-09p-96z+1,03=0$	Sept. 12	2	$e+85x+24p-87z+0,90=0$
17	1	$e+84x-26p-75z+2,24=0$	15	2	$e+86x+20p-91z+0,19=0$
20	2	$e+81x-33p-68z+0,83=0$	18	2	$e+86x+16p-94z+0,56=0$
29	1	$e+76x-45p-42z+2,27=0$	20	2	$e+87x+13p-96z+0,08=0$
30	1	$e+75x-46p-39z+0,79=0$	Oct. 4	2	$e+88x-08p-96z+0,86=0$
Nov. 2	1	$e+74x-49p-32z+1,79=0$	5	2	$e+87x-10p-94z+1,56=0$
8	1	$e+69x-56p-12z-0,28=0$	18	2	$e+83x-28p-73z+1,35=0$
Dec. 13	2	$e+22x-85p+90z-0,10=0$	25	2	$e+79x-39p-55z+0,84=0$
15 & 23	2	$e+13x-87p+96z+0,10=0$	Nov. 1	2	$e+74x-48p-35z+0,43=0$
16	3	$e+17x-86p+93z-0,70=0$	2	2	$e+74x-49p-32z-0,22=0$
26	4	$e+02x-88p+98z+1,45=0$	Dec. 2	2	$e+38x-80p+68z+0,92=0$
29	2	$e-03x-88p+98z+1,57=0$	11	1	$e+24x-85p+87z+0,59=0$
30	2	$e-04x-88p+97z+1,76=0$	19	2	$e+13x-87p+96z+0,95=0$
1820 Jan. 2	2	$e-09x-88p+96z+1,46=0$	23	2	$e+06x-88p+99z-0,35=0$
5	2	$e-13x-86p+92z+0,90=0$	28	2	$e-03x-88p+98z+0,84=0$
15	2	$e-29x-82p+73z+1,48=0$	1821 Jan. 2	2	$e-10x-88p+96z+0,98=0$
16	2	$e-31x-82p+70z+1,12=0$	13	2	$e-28x-83p+77z+0,92=0$
March 2	2	$e-80x-37p-70z+1,08=0$	19	2	$e-37x-80p+63z+0,43=0$
8	2	$e-83x-28p-83z+0,87=0$	Feb. 1	2	$e-54x-70p+22z-0,73=0$
19	2	$e-88x-11p-97z-0,21=0$	2	2	$e-55x-69p+19z-0,12=0$
22	2	$e-88x-07p-99z+0,16=0$	6	2	$e-60x-64p+05z+0,15=0$
24	2	$e-88x-04p-98z+0,41=0$	8	2	$e-62x-62p-02z+1,05=0$
25	2	$e-88x-02p-98z+1,36=0$	10	2	$e-64x-60p-08z+0,70=0$
April 5	2	$e-86x+14p-90z-0,35=0$	14	2	$e-68x-56p-22z+2,19=0$
6	2	$c-86x+15p-89z-0,47=0$	19	2	$e-72x-50p-39z-0,57=0$
July 5	2	$e+12x+87p+93z+0,19=0$	24	2	$e-76x-42p-53z+1,86=0$
7	2	$e+14x+87p+90z-1,27=0$	27	2	$e-79x-40p-62z+0,16=0$
8	2	$e+16x+87p+89z-1,14=0$	March 9	2	$e-85x-24p-85z+0,95=0$
10	2	$e+19x+86p+87z-0,75=0$	10	2	$e-85x-23p-87z+0,67=0$
13	2	$e+22x+85p+84z-1,02=0$	11	2	$e-85x-21p-89z+0,46=0$
15	2	$e+24x+84p+80z-1,99=0$	12	2	$e-85x-20p-90z+0,15=0$
18	2	$e+29x+82p+73z+0,11=0$	13	2	$e-86x-19p-91z+1,76=0$

α Lyræ.

Date of observation.		Equations of condition.	Date of observation.		Equations of condition.
1821			1821		
March 15	2	$e-,87x-,15p-,93z+1,87=0$	Oct. 14	2	$e+,85x-,22p-,82z+0,43=0$
19	2	$e-88x-09p-97z+1,85=0$	23	2	$e+80x-37p-61z+1,45=0$
21	2	$e-88x-06p-99z+2,12=0$	29	2	$e+76x-44p-43z+0,10=0$
22	2	$e-88x-05p-99z+0,99=0$	Nov. 27	2	$e+45x-75p+53z-0,55=0$
July 6	2	$e+12x+87p+92z-1,28=0$	28	2	$e+43x-76p+56z+0,91=0$
10	2	$e+18x+86p+88z-1,33=0$	29	2	$e+42x-77p+59z+0,39=0$
11	2	$e+19x+86p+86z-0,74=0$	Dec. 3	2	$e+37x-80p+70z+0,38=0$
13	2	$e+22x+85p+84z-0,53=0$	5	2	$e+34x-82p+74z+0,88=0$
18	2	$e+29x+83p+73z+1,00=0$	6	2	$e+32x-82p+76z+1,68=0$
20	2	$e+32x+82p+68z-1,36=0$	11	2	$e+24x-85p+87z+0,33=0$
23	2	$e+37x+80p+61z-1,40=0$	17	2	$e+16x-86p+94z+0,61=0$
25	2	$e+39x+79p+55z+1,13=0$	21	2	$e+09x-88p+98z+1,11=0$
27	2	$e+42x+77p+48z-1,16=0$	24	2	$e+05x-88p+99z+0,62=0$
Aug. 1	2	$e+48x+74p+35z-0,77=0$	26	2	$e+02x-88p+98z+0,24=0$
2	2	$e+49x+74p+32z-0,88=0$	30	2	$e-04x-88p+97z+0,03=0$
4	2	$e+51x+72p+26z-1,43=0$	31	2	$e-06x-88p+97z+0,54=0$
14	1	$e+63x+61p-08z-1,30=0$	1822 Jan. 1	2	$e-07x-88p+97z+1,76=0$
16	2	$e+65x+59p-15z-0,18=0$	4	2	$e-11x-87p+93z+0,64=0$
23	2	$e+71x+51p-39z-1,77=0$	5	2	$e-13x-87p+92z+0,59=0$
24	2	$e+72x+50p-42z+0,95=0$	6	2	$e-16x-87p+90z+1,04=0$
Sept. 3	2	$e+80x+38p-68z-0,63=0$	16	2	$e-31x-82p+70z+1,14=0$
9	2	$e+83x+29p-81z-0,59=0$	29	2	$e-49x-74p+32z-0,04=0$
12	2	$e+85x+24p-87z-0,02=0$	30	2	$e-50x-73p+29z+0,17=0$
22	2	$e+88x+09p-98z+1,18=0$	Feb. 5	2	$e-57x-66p+09z+1,23=0$
26	2	$e+88x+04p-98z+1,26=0$	7	2	$e-60x-64p+02z+1,69=0$
27	2	$e+88x+02p-98z+0,10=0$	11	2	$e-64x-60p-12z+1,52=0$
28	2	$e+88x+01p-98z-0,19=0$	14	2	$e-66x-57p-22z+0,54=0$
29	2	$e+88x-01p-98z+0,32=0$	15	2	$e-67x-55p-25z+0,34=0$
Oct. 1	2	$e+88x-04p-97z+1,22=0$			
8	2	$e+87x-14p-90z+1,07=0$			

TABLE III.

α Lyræ.

		☉ Long. s . o	Solar Nutation. Contrary sign.	Sum of 3 Equations Pr. ab. and s. n.		Coeff. of x.	Coeff. of p.	Coeff. of z.
January	1	9 . 10	−0,47	−0,95	3,06	−,07	−,88	+,97
	10	20	−0,41	−4,01	2,98	−,22	−,85	+,84
	20	10 . 0	−0,29	−6,99	2,78	−,37	−,80	+,61
	30	10	−0,14	−9,77	2,48	−,50	−,73	+,29
February	9	20	+0,02	−12,25	2,09	−,62	−,62	−,05
	19	11 . 0	+0,18	−14,34	1,64	−,72	−,51	−,39
March	1	10	+0,32	−15,97	1,11	−,80	−,38	−,68
	11	20	+0,42	−17,08	0,54	−,85	−,23	−,89
	21	0 . 0	+0,47	−17,62	0,06	−,88	−,08	−,99
	31	10	+0,47	−17,56	0,66	−,88	+,07	−,97
April	10	20	+0,41	−16,90	1,24	−,85	+,22	−,84
	20	1 . 0	+0,29	−15,66	1,78	−,80	+,37	−,61
May	1	10	+0,14	−13,88	2,22	−,73	+,50	−,29
	11	20	−0,02	−11,66	2,63	−,63	+,62	+,05
	21	2 . 0	−0,18	−9,03	2,91	−,51	+,72	+,39
June	1	10	−0,32	−6,12	3,10	−,38	+,80	+,68
	11	20	−0,42	−3,02	3,21	−,23	+,85	+,89
	22	3 . 0	−0,47	+0,19	3,20	−,08	+,88	+,99
July	2	10	−0,47	+3,39	3,10	+,07	+,88	+,97
	13	20	−0,41	+6,49	2,90	+,22	+,85	+,84
	23	4 . 0	−0,29	+9,39	2,65	+,37	+,80	+,61

α Lyræ.

	☉ Long. s . o	Solar Nutation. Contrary sign.	Sum of 3 Equations Pr. ab. and s. n.		Coeff. of x.	Coeff. of p.	Coeff. of z.
August 3	4 . 10	−0,14	+12,04	2,33	+,50	+,73	+,29
13	20	+0,02	+14,37	1,94	+,62	+,62	−,05
23	5 . 0	+0,18	+16,31	1,52	+,72	+,51	−,39
September 3	10	+0,32	+17,83	1,07	+,80	+,38	−,68
13	20	+0,42	+18,90	0,61	+,85	+,23	−,89
23	6 . 0	+0,47	+19,51	0,10	+,88	+,08	−,99
October 3	10	+0,47	+19,61	0,38	+,88	−,07	−,97
13	20	+0,41	+19,23	0,84	+,85	−,22	−,84
23	7 . 0	+0,29	+18,39	1,30	+,80	−,37	−,61
November 3	10	+0,14	+17,09	1,74	+,73	−,50	−,29
13	20	−0,02	+15,35	2,14	+,62	−,62	+,05
22	8 . 0	−0,18	+13,21	2,46	+,51	−,72	+,39
December 2	10	−0,32	+10,75	2,74	+,38	−,80	+,68
12	20	−0,42	+ 8,01	2,94	+,23	−,85	+,89
22	9 . 0	−0,47	+ 5,07	3,02	+,08	−,88	+,99
January 1	10	−0,47	+ 2,05		−,07	−,88	+,97

Erratum.—Page 9, insert the sign — before 8″,28